DEPARTMENT OF ENERGY
ROCKY FLATS PROJECT OFFICE

ASSESSMENT OF KAISER-HILL, LLC.
SAFETY SOFTWARE QUALITY ASSURANCE
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Assessment of Kaiser-Hill, LLC. Safety Software Quality Assurance

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U.S. Department of Energy
Rocky Flats Project Office (RFPO)
Assessment of Kaiser-Hill Safety Software Quality Assurance

EXECUTIVE SUMMARY

The DOE Rocky Flats Project Office (RFPO) conducted an assessment of software quality assurance (SQA) processes of the Kaiser-Hill, LLC. (K-H) during the period August 23 - 26, 2004. K-H is managing the decontamination and decommissioning (D&D) at the RFPO as a prime contractor. The assessment was undertaken to fulfill field office commitments in the DOE's Implementation Plan, *Quality Assurance for Safety Software at Department of Energy Defense Nuclear Facilities,* for Defense Nuclear Facilities Safety Board Recommendation 2002-1.

K-H is responsible for the D&D of all the remaining facilities, Rocky Flats. Several of these facilities are still categorized as nuclear facilities (based upon the remaining radiological inventory) and require documented safety analyses (DSA).

The overall objective of the assessment was to determine the adequacy of SQA processes for safety analysis and design software of nuclear facilities, including review of supporting databases and calculation software. The assessment focused on software that K-H Site Quality Program Office and RFPO had identified as safety analysis and design software, and software that the assessment team judged had "the potential to cause radiological harm." As stated in the K-H Computer Software Management Manual (1-MAN-004-CSMM), "this manual applies to Nuclear-Related Software where the consequence of inadequate data or control could result in radiological harm to site workers, the public, or the environment…" The supporting drivers for this manual are derived from the K-H Quality Assurance Program Document (QAPD), ASME-NQA-1, the Price-Anderson Amendment Act (PAAA) and QA requirements as specified in 10 CFR 830.122 (QA Rule). Also, the K-H Quality Assurance Program Manual (MAN-131-QAPM) states, "From the perspective of applicability and enforceability, 10 CFR 830.122 applies to nuclear facilities and nuclear activities (activities with the potential to cause radiological harm), and DOE Order 414.1A applies to non-nuclear facilities, activities and services."

The assessment was based on the criteria and approach documents developed by the DOE Office of Assistant Secretary for Environment, Safety, and Health (EH). This included but was not limited to the CRAD 4.2.4.1 that "safety analysis and design software includes database programs and associated user files used to maintain control of information that has nuclear safety implications." The following were the eight areas of SQA assessment:

- Software Requirements Description
- Software Design Description
- Software User Documentation

- Software Verification and Validation (V&V)
- Software Configuration Management
- Software Quality Assurance
- Software Procurement
- Software Reporting and Corrective Action

The assessment team identified several noteworthy practices.

- Some K-H software applications had evolved over a number of years and had gained considerable maturity.

- For each software application reviewed, copies of previous versions were readily available on either diskette, CD, or from an intranet site.

- Three versions of CAPARS (Versions 1.0, 3.0, and 5.2) were adequately V&V tested and results documented.

- While the configuration management of CAPARS did not meet NQA-1, it was consistent with industry practices.

The assessment team also found deficiencies in the K-H SQA program that represent non-compliances with requirements. The assessment team categorized these deficiencies as either a finding (non-compliance with specific requirements), or an observation (area recommended for improvement). The assessment team identified 6 findings and 2 observations, which are listed below.

Findings:

F-1: *Software engineering consensus standards or any other technical standards were not applied to the development and maintenance of software applications reviewed that are regulated under the QA Rule.*

F-2: *K-H did not follow their CSMM and generate required documentation and/or establish control processes for any nuclear-related software application reviewed.*

F-3: *K-H did not have objective evidence that the supplier of the COTS safety software reviewed were evaluated prior use.*

F-4: *The K-H SQA program had not ensured implementation of all their configuration management requirements for any nuclear-related software application reviewed.*

F-5: *K-H management assessment and independent assessment programs did not effectively address nuclear-related software reviewed.*

F-6: *Users of nuclear-related software reviewed were not trained on applicable regulations and procedures.*

Observations:

O-1: *K-H should retire nuclear-related software that is no longer in use.*

O-2: *Improvement is needed in documenting the significance of nuclear-related software errors, and how these errors were managed/addressed within the associated nuclear facility safety analysis documentation.*

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LIST OF ACRONYMS

COTS	Commercial-Off-The-Shelf
CFR	Code of Federal Regulations
CRAD	Criteria, Review, and Approach Document
CSMM	Computer Software Management Manual
D&D	Decontamination and Decommissioning
DSA	Documented Safety Analysis
DNFSB	Defense Nuclear Facilities Safety Board
EOC	Emergency Operations Center
K-H	Kaiser-Hill, LLC.
NFPA	National Fire Protection Association
NQA	Nuclear Quality Assurance
RFPO	DOE Rocky Flats Project Office
SBMS	Standards Based Management System
SDD	Software Design Description
SQA	Software Quality Assurance
SRD	Software Requirements Description
V&V	Verification and Validation
QA	Quality Assurance
QAMM	Computer Software Management Manual
QAPD	Quality Assurance Program Description

U. S. Department of Energy
Rocky Flats Project Office (RFPO)
Assessment of Kaiser-Hill, LLC. Safety Software Quality Assurance

1.0 Introduction

This report presents the results of a Rocky Flats Project Office (RFPO) assessment of safety software quality assurance (SQA) processes of the Kaiser-Hill, LLC. (K-H) under a contract with RFPO. The assessment was conducted during the period August 23-26, 2004. The background and objectives of the assessment are discussed below.

1.1 Background

The DOE Implementation Plan [1] for Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2002-1, *Quality Assurance for Safety-Related Software,* September 2002, defines the actions DOE is taking to ensure the quality of safety software at defense nuclear facilities. Safety software includes safety analysis and design software. Commitment 4.2.4.3 of this plan required assessments of the processes in place to ensure that safety software currently used to support the analysis and design of defense nuclear facilities is adequate. The present assessment was undertaken to fulfill this commitment relative to safety software currently used by K-H.

K-H is responsible for all the nuclear facilities and nuclear activities at RFPO, which involves the use of at least four analysis safety software applications.

1.2 Objectives and Criteria

The overall objective of the assessment was to determine the adequacy of SQA processes for safety analysis and design software of nuclear facilities, including review of supporting databases and calculation software. The assessment focused on software that K-H Site Quality Program Office and RFPO had identified as safety analysis and design software, and software that the assessment team judged had "the potential to cause radiological harm." As stated in the K-H Quality Assurance Program Manual (QAPM) [2], "From the perspective of applicability and enforceability, 10 CFR 830.122[3] (QA Rule) applies to nuclear facilities and nuclear activities (activities with the potential to cause radiological harm), and DOE Order 414.1A applies to non-nuclear facilities, activities, and services." The K-H Computer Software Management Manual (CSMM) [4] identifies the Price-Anderson Amendments Act (PAAA) and the associated QA requirements specified in 10 CFR 830.120, and ASME-NQA-1 (1994 edition) Subpart 2.7 [5] as the supporting drivers for this manual. The assessment team used this criteria in order to limit the scope of the assessment to software with a role in safety.

The assessment was based on the criteria and review approach documents (CRADs) developed by the DOE Office of Assistant Secretary for Environment, Safety, and Health (EH). This includes, but is not limited to, the CRAD 4.2.4.1 [(6)] guideline that "safety analysis and design software includes database programs and associated user files used to maintain control of information that has nuclear safety implications." The scope of this assessment was broader than CRAD 4.2.4.1 so that RFPO could assure it had a reasonable understanding of the adequacy of software quality assurance in K-H.

The QAPM is K-H's top-level document for establishing quality assurance requirements. It implements 10 CFR 830, Subpart A, and DOE Order 414.1A, *Quality Assurance*, Attachment 2, "Contractor Requirements Document on Quality Assurance." Compliance with the QAPM is mandatory for all of K-H's DOE-related activities. Implementation of the QAPM is supported by K-H CSMM and Quality Assurance Program Document (QAPD). The results of this SQA assessment, therefore, were keyed to K-H's specific requirements in the CSMM and QAPM.

1.3 Report Organization

Sections 2 and 3 discuss the scope and approach of the assessment. Table 1 in Section 3 identifies the specific computer codes and applications reviewed. Section 4 presents the results of the assessment in terms of findings and observations. The findings represent conditions that do not conform to requirements. Section 5 provides brief summaries of assessment areas described in the DOE CRAD, including whether the specified criteria were met. These summaries cross-reference the concern, findings, and observations in Section 4 to identify issues described in the specific assessment areas.

Appendices A-1 and A-2 are lists of documents reviewed and personnel interviewed, respectively, in support of this assessment. Appendix B provides brief biographies of assessment team members.

2.0 SCOPE OF ASSESSMENT

K-H is responsible for the decontamination and decommissioning (D&D) of all the remaining facilities at Rocky Flats. Several of these facilities are still categorized as nuclear facilities (based upon the remaining radiological inventory) and require documented safety analyses (DSA). The assessment team reviewed SQA processes associated with safety software used by K-H for development of these DSAs. The assessment of SQA processes also included review of supporting database and calculation software.

The assessment team also reviewed a sample of other software that they judged had "the potential to cause radiological harm," including database programs and other safety management software that have nuclear safety implications Software applications of this type are used by K-H for DOE contractor-operated facilities across the Rocky Flats Site.

Such applications included radiological dose assessment and radiation exposure monitoring. This software still must be developed and maintained in accordance with the requirements of QA Rule. The assessment was based on the CRAD developed by DOE-EH. Some software evaluated by the assessment team was outside the scope of the EH CRAD, although it was within the scope of the QA Rule. This software was included to assure RFPO had a reasonable understanding of the adequacy of the control of software with a role in safety.

3.0 ASSESSMENT APPROACH AND TAILORING

3.1 Software Identification and Selection

An initial step in this assessment, undertaken with K-H's assistance, was the review of K-H's software classified as safety software using the definitions in DOE CRAD 4.2.4.1, as well as other software that is subject to the requirements of the QA Rule. This enabled the assessment team to select computer codes for assessment of SQA processes. This enabled K-H to identify and provide, or to keep ready for review at the facility, a significant portion of the requested documents for the team's review; and to develop a preliminary schedule for interviews with key personnel.

A starting point for identifying the safety analysis and design codes was the results of surveys of such codes completed as part of previous commitments in the DOE Implementation Plan for DNFSB Recommendation 2002-1. A careful selection of computer codes was necessary because several factors affect the applicable SQA processes. These factors included: (a) the type of software (COTS, government agency sponsored, or custom); (b) model complexity (affecting user understanding, interaction, documentation, and code validation method); (c) age (affecting the nature of available life cycle documentation and how "legacy" software is brought into compliance); and (d) whether the software is "currently used". The list of selected safety analysis and design software is shown in Table 1.

3.2 Software Assessment

The DOE CRAD for SQA assessment identifies eight broad areas covering the typical software life cycle:

- Software Requirements Description
- Software Design Description
- Software User Documentation
- Software Verification and Validation (V&V)
- Software Configuration Management
- Software Quality Assurance
- Software Procurement
- Software Reporting and Corrective Action

The assessment team evaluated each of these areas to the extent it deemed appropriate. The assessment team's review for each area followed the approach described in the CRAD for that area.

TABLE 1
List of Selected Safety Analysis and Design Software Used by K-H

Name, Owner and Version	*Type of Application*	*Application/Function*
RADIDOSE Versions 1.1, 1.2, 1.3, 1.4, 1.4.1, 1.4.2, and 1.4.3.	Safety analysis of nuclear facilities	Radiological Dose calculation in relation to a radiological event.
CFAST/FAST Version 3.1.7	Fire hazards analysis of nuclear facilities	Analytical zone modeling and analysis of fires in structures.
HASS Versions 6.1 through 7.6 Rev.3	Fire Analysis of nuclear facilities	Hydraulic/flow calculations in support of fire protection analysis.
CAPARS Versions 3.0, 4.0 and 5.2	Computer-Assisted Protective Action Recommendation System	Emergency response application to hazardous/radiological airborne plume dispersion events.

RADIDOSE, a Microsoft Excel workbook, is a software application for evaluating radiological doses for accident scenarios often postulated for RFETS (RFPO). Its purpose is to lend consistency to analyses performed by different analysts and to speed the calculation of doses from a wide variety of postulated accidents.

CFAST/FAST (Consolidated Fire and Smoke Transport/Fire and Smoke Transport) is a collection of fire modeling software applications, which uses the underlying fire model CFAST and adds the routines of FIREFORM to provide engineering calculations of fire phenomena in compartmented structures.

HASS (Hydraulic Analysis of Sprinkler Systems) is a dynamic fire protection software application used by engineers and sprinkler contractors. It helps to determine water supply adequacy based on system demand and distribution piping.

CAPARS (Computer Assisted Protective Action Recommendation System) is an integrated system of eleven major computer software packages providing an emergency response atmospheric dispersion model that was implemented at Rocky Flats in August 1988 (formerly known as TRAC). The model, known as the Terrain-Responsive Atmospheric Code (TRAC) was later incorporated into the Computer-Assisted Protective Action Recommendation System or CAPARS for predicting the path and impacts from a toxic chemical emergency.

The criteria and approach in the CRAD in certain areas required tailoring. For example, software requirements description and software design description areas do not fully apply to procured COTS software. Similarly, V&V applies differently to COTS, where the assessment focused on installation V&V and proper validation using test problems and cases appropriately matched to the intended software application.

The qualification and training of software users was an important element in this assessment, especially for relatively complex safety analysis codes where significant technical expertise is needed for proper code validation, problem modeling, and correct use of the software for diverse applications. The assessment criteria provided in the DOE CRAD do not address this aspect explicitly, although they refer to user training as part of one item in describing the approach for software user documentation assessment area. The assessment team augmented its lines of inquiry in this assessment area to address software user qualifications and training in greater detail.

The assessment team made field visits, reviewed documents, and interviewed personnel to gather data and information for the assessment. During the field review of a particular software application, the team ensured that appropriate K-H staff were involved. The following provides examples of the types of general and software-specific documents that were reviewed, depending on their applicability to SQA processes and activities; and the types of personnel who were interviewed. The full lists of documents reviewed and personnel interviewed are provided in Appendices A-1 and A-2, respectively.

The following are examples of types of requirements and background documents that were within the scope of this assessment review:

- DOE and K-H SQA assurance requirements documents
- Project-specific SQA requirements and procedures
- Self-assessments, audits, and independent assessments
- List of databases that may have safety implications
- List of evaluated suppliers of software and technical services
- Occurrence reports and corrective action requests/reports

The following are examples of types of software-specific documents that were within the scope of this assessment review:

- Description of current work related to the software, including changes
- Software functional and requirements and descriptions
- Software design description
- Software development and management plans covering the entire lifecycle
- Products during and following software development
- Program description manuals, user manuals, guides, and instructions
- Audit reports; problem/resolution and corrective action reports
- List of individuals that performed V&V and their qualifications
- List of authorized users

- Sample input and output files

The following are examples of key personnel interviewed:

- Principal user
- Users of software
- Managers
- Individuals responsible for developing and implementing software modifications
- Individuals responsible for software V&V
- Nuclear safety (authorization basis) staff
- Quality assurance manager and staff

K-H staff members accompanied the assessment team throughout its fieldwork to facilitate the reviews, provide assistance in obtaining the necessary additional documents, and understand the issues identified. In addition, daily exit meetings with K-H staff were held. At the completion of its fieldwork, the assessment team provided a comprehensive out-brief to DOE and K-H organizations, which presented all the preliminary results of the assessment.

Additional document reviews and discussions with K-H personnel were conducted as necessary to bring closure to open issues and finalize the results. A draft of this report was provided to K-H for a review of factual accuracy. The assessment team considered all review comments before finalizing the report.

4.0 ASSESSMENT RESULTS

The following is a discussion of the results of the team's assessment of the safety software quality assurance processes of K-H. Deficiencies were categorized as either a finding (non-compliance with specific requirements) or an observation (area recommended for improvement). Most of these deficiencies cut across several assessment areas, therefore all the essential information from relevant assessment areas which supports a given deficiency is included with each deficiency. Brief summaries of the assessment areas with references to the results discussed below are provided in section 5.

The assessment team identified a few noteworthy practices.

- Some K-H software applications have evolved over a number of years and have gained considerable maturity.
- For each software application reviewed, copies of previous versions were readily available on either diskette, CD, or from an intranet site.
- Three versions of CAPARS (Versions 1.0, 3.0, and 5.2) were adequately V&V tested and results documented.
- While the configuration management of CAPARS did not meet NQA-1, it was consistent with industry practices.

However, the assessment found several deficiencies in K-H's implementation of software quality assurance requirements.

4.1 Findings

(F-1) Finding RFPO-04-0020-F01

Software engineering consensus standards or any other technical standards were not applied to the development and maintenance of software applications reviewed that are regulated under the QA Rule.

Requirements:

1. MAN-131-QAPM, *Quality Assurance Program Manual,* Section 3. "Requirements Documents," states, "From the perspective of applicability and enforceability, 10 CFR 830.122 applies to nuclear facilities and nuclear activities (activities with the potential to cause radiological harm), and DOE Order 414.1A applies to non-nuclear facilities, activities, and services."

2. 1-MAN-004-CSMM, *Computer Software Management Manual,*
   - Section 4. *Requirements*, A. *General,* first paragraph states, "Application Manager(s) shall develop a computer software management program for Nuclear-Related Software in use at the Site by applying the criteria specified in this manual. The computer software management program will include a discussion of how the criteria of this manual SHALL be satisfied and implemented. Work SHALL be performed to established, technical standards and administrative controls using approved manuals, instructions, or other appropriate documentation in accordance with 1-MAN-001-SDRM."
   - Section 1. *Overview*, first paragraph last sentence, states, "The supporting drivers for this manual are derived from the following sources...ASME-NQA-1 (Quality Assurance Program Requirements for Nuclear Facilities), 1994 Edition, Subpart 2.7 (Quality Assurance Requirements of Computer Software for Nuclear Facility Applications)."
   - Section 4. *Requirements*, B. *Software Development or Modification,* second to the last paragraph states, "At the start of the computer software life cycle, each development, modification, or application effort SHALL identify the following: Standards, conventions, techniques, or methodologies that guide Nuclear-Related Software development, and Software items and processes SHALL be designed using sound engineering/scientific principles and appropriate standards."
   - Section 2. *Definitions*, *Nuclear-Related Software*, states, "The site software or software systems, including but not limited to software that is purchased, developed, or modified that is intended for use in connection with any activity that has potential to cause radiological harm. Nuclear-Related Software includes, but is not limited to, embedded software and software used to inventory, monitor, measure, control, and/or manipulate nuclear materials radiological waste, the immediate physical environment of such materials, and/or the health and safety of people who might be exposed to hazards from such materials."

3. 10 CFR 830.121, (c) states in part, "The QAP must ...use voluntary consensus standards in its development and implementation, where practicable and consistent with contractual and regulatory requirements, and identify the standards used."

Discussion:

In specifying the development of a quality assurance program, the QA Rule stated, "Use voluntary consensus standards in its development and implementation, where practicable and consistent with contractual and regulatory requirements, and identify the standards used." The usual interpretation of this requirement is that a contractor indemnified under the Price Anderson Amendments Act (PAAA) will base its quality assurance program and procedures on specific consensus standards, such as ASME NQA-1, *Quality Assurance Requirements for Nuclear Facilities*. The contractor would explicitly identify the standard as the basis for its program.

For specific topical areas like computer software control, additional standards would be identified. For example, many DOE contractors identify NQA-1, Subpart 2.7 "Quality Assurance Requirements for Computer Software for Nuclear Facility Applications" as the standard they implement for computer software control. As an alternative, a suite of software engineering standards of the Institute of Electrical and Electronics Engineers (IEEE) could be chosen. Regardless of what standard set is chosen, it is the intent of both the QA Rule and DOE O 414.1, *Quality Assurance,* that all contractors identify consensus standards on which they build their quality assurance programs. The QA Rule and NQA-1 were the drivers of K-H CSMM, however the assessment team did not find any evidence of their use for the software applications reviewed.

The K-H Computer Software Management Manual (1-MAN-004-CSMM) required that "Application Manager(s) shall develop a computer software management program for Nuclear-Related Software in use at the Site by applying the criteria specified in this manual." In the case of RADIDOSE, HASS and CFAST applications, K-H did not have a software management program established consistent with consensus or industry standards.

K-H does have software quality assurance procedures in place to address nuclear-related software that has the "potential to cause radiological harm," however for nuclear-related software reviewed, the associated projects did not specify consensus standards or any other technical standards to be applied to activities affecting quality, such as software engineering which made objective review of these projects difficult. The assessment team believes that the weak commitment to consensus standards has inhibited K-H from consistently satisfying the requirement for implementation of consensus standards in areas such as software engineering and records management. The following are conditions that led the assessment team to its conclusion:

RADIDOSE

K-H provides seven versions of RADIDOSE for system users. The assessors determined that a formal software requirements description did not exist for any version. As a result no software standard was specified.

The nuclear safety calculation document (CALC-RFP-00.0958-VLP) for RADIDOSE Version 1.4.3 (and all subsequent versions) documented that the acceptance criteria was "N/A" (not applicable).

CAPARS

Currently K-H utilizes Version 3.0 of CAPARS for emergency events involving airborne hazardous materials. K-H did not have for CAPARS a formal, approved, document outlining the requirements and/or design description, including system operation documentation. As a result, no software standard can be determined.

An unapproved overview document described the operation of CAPARS, but did not specify what software standard(s) were used.

CFAST/FAST

This code is considered commercial off-the-shelf (COTS) software. Since this application was obtained free of charge in 1994, there was no software procurement specifications or design requirements documented. K-H could not find any installation test documentation that would show the results of test problems ran on selected computer systems.

HASS

This code is also COTS software, and was procured in 1997. The assessment team had requested K-H to provide the procurement documentation for this software so that they could determine what software standards were applied, however K-H looked and could not find this documentation.

RFPO Closure Required: YES [X] NO [ ]

(F-2) Finding RFPO-04-0020-F02

K-H did not follow their CSMM and generate required documentation and/or establish control processes for any nuclear-related software application reviewed.

Requirements:

1. 1-MAN-004-CSMM, *Computer Software Management Manual,*
   - Section 4. *Requirements*, F. *Documentation and Records,* first paragraph states, "Documents of software SHALL, as a minimum, include the following: software requirements specification, software design description, verification and model validation documentation, user documentation, description of mathematical models and numerical methods (as applicable), code assessment and support (verification and validation records), continuing documentation and code listings (problem reports and change notifications)."
   - Section 4. *Requirements*, B. *Software Development or Modification,* second to the last paragraph states, "At the start of the computer software life cycle, each development, modification, or application effort SHALL identify the following: Required documentation, required nuclear related software and documentation reviews, standards, conventions, techniques, or methodologies that guide nuclear-related software development, and software items and processes SHALL be designed using sound engineering/scientific principles and appropriate standards."

- Section 4. *Requirements*, C. *Computer software Verification and Validation,* first, second and third paragraphs state, "Verification of Nuclear-Related Software and model validation SHALL be planned and performed before the use of Nuclear-Related Software. Verification and validation plans SHALL employ methods such as inspection, analysis, demonstration, and testing to ensure that Nuclear-Related Software correctly performs all intended functions. These plans also ensure that Nuclear-Related Software does not perform any function that, either by itself or in combination with other functions, can degrade the entire system. Verification activities SHALL be integrated into the software life cycle and performed to ensure software requirements are correctly specified and implemented in the design criteria, test documentation, and completed code. Such verifications SHALL ensure traceability of test results to specified functional requirement."
- Section 2. *Definitions, Nuclear-Related Software*, states, "The site software or software systems, including but not limited to software that is purchased, developed, or modified that is intended for use in connection with any activity that has potential to cause radiological harm. Nuclear-Related Software includes, but is not limited to, embedded software and software used to inventory, monitor, measure, control, and/or manipulate nuclear materials radiological waste, the immediate physical environment of such materials, and/or the health and safety of people who might be exposed to hazards from such materials."

Discussion:

The K-H CSMM specified a list of documentation required for nuclear-related software (see above requirement), however K-H did not follow this manual and generate some of the required documentation, such as requirements description, or V&V planning and test case specification documentation for any applications reviewed. The following are examples that led the assessment team to this conclusion:

- For RADIDOSE (all seven versions) and CAPARS, there is no software requirements specification or formal V&V plan. A description of the mathematical models used within RADIDOSE exists in the calculation description and an output exists for the mathematical equations used, however K-H did not have available for review the software application used for producing the output. The CSMM does allow for hand calculation verification, but K-H did not have any written record for this form of verification.

- The intranet and Internet site applications that provide an interface to RADIDOSE and CAPARS (respectively) have undergone recent development changes; however K-H has not conducted a formal test to validate the changes as specified in the CSMM. Also, no requirements or design description could be found by K-H for the assessment team to review.

- K-H did not have requirements documentation or installation test documentation that would show the results of test problems ran on selected computer systems for HASS.

- Formal requirements descriptions were not maintained current with the state of the software for the database applications used for development of safety basis documentation (such as DSAs).

There is no industry accepted software management and control for the applications of RADIDOSE, CFAST, HASS, and CAPARS at RFPO. The overall impact of such a system is not formally known. For example, there does not exist documentation for an accurate list of authorized users or documented training and qualification requirements for use of the RADIDOSE code. The custodian for RADIDOSE application interviewed by the assessment team said that any Rocky Flats employee could download and use any version of the code without any custodian control, version validation, or verification of user qualifications.

RFPO Closure Required: YES [X] NO [ ]

(F-3) Finding RFPO-04-0020-F03

K-H did not have objective evidence that the supplier of the COTS safety software reviewed were evaluated prior use.

Requirements:

1. 10 CFR 830.122(g), Section 7, paragraph (2) states, "Evaluate and select prospective suppliers on the basis of specified criteria."

2. 1-MAN-004-CSMM, *Computer Software Management Manual,* Section 4. *Requirements*, H. *Inspection and Acceptance Testing* states, "Inspection and testing of specified items, services and processes SHALL be conducted using established acceptance and performance criteria."

Discussion:

The assessment team reviewed procurement documents for several suppliers who provided computer software. The assessment team compared source selection information with DOE requirements and clarifying information in DOE G 414.1-2, *Quality Management System Guide for use with 10 CFR 830.120 and DOE O 414.1.* Section 4.7.3 of DOE G 414.1-2 states, "Prospective suppliers should be evaluated to verify their capability to meet performance and schedule requirements… The method or combination of methods chosen should provide adequate confidence that the supplied item or service will meet requirements."

Contrary to requirements 1 and 2 above, K-H did not have objective evidence that the supplier of HASS was evaluated prior to use of this software application.

RFPO Closure Required: YES [X] NO [ ]

(F-4) Finding RFPO-04-0020-F04

> ***The K-H SQA program had not ensured implementation of all their configuration management requirements for any nuclear-related software application reviewed.***

Requirements:

- 1-MAN-004-CSMM, *Computer Software Management Manual,* Section 4 *Requirements,* D. *Configuration Management*, first paragraph states, "A Nuclear-Related Software configuration management system SHALL be established to ensure positive identification and control of Nuclear-Related Software baselines and changes. The configuration management system SHALL include the following elements:

  Configuration Identification-
  - Uniquely identifies each configuration item including identification of software version in the output, when feasible.
  - Identifies changes to a configuration item in relation to other configuration items.
  - Directly relates each code version with its associated documentation.

  Configuration Change Control-
  - A description of the change(s) shall be provided as follows: (a) The identification of originating organization, (b) The reason for the change, (c) The identification of the affected baselines and computer software configuration items, and (d) evidence of evaluation, coordination, and approval.

  Configuration Accounting-
  - Configuration accounting information SHALL be documented and identify the approved configuration, status, proposed changes to the configuration, status of approved changes, and information to support the functions of the configuration identification, and configuration control."

Discussion:

The K-H SQA program did not have adequate configuration management for any nuclear-related software application reviewed. The following are examples of this issue:

- No formal system is in place to notify users of errors for specific versions of RADIDOSE. Currently, any version of RADIDOSE can be accessed (via a RFPO intranet site) without the potential user being advised of errors that exist in some versions.

  The original developer for RADIDOSE no longer works at the RFPO, and is not currently available to address or communicate to others any problem that is found. Also, there is no current backup to the original developer. If the original developer were unavailable to assist, a person would have to be found with the skills to analyze the RADIDOSE system, attempt to fix it, and communicate the software error with the corrected version to the appropriate RADIDOSE users.

- In the case of RADIDOSE, no formal list of application versions exists that identify which version of the software is authorized for use. This is indicative of issues tied to configuration accounting and control. The problem inherent with not maintaining tight control and accountability is that numerous versions of the application could be potentially used without prior authorization, potentially leading to inconsistent results and output. In addition, no single point of contact was identified for distributing authorized versions of the application and no internal configuration identification existed to allow a user to determine when a given version of software was or is appropriate for use.

  It should be noted that specific versions of RADIDOSE are tied to specific authorization basis documentation via a safety analysis procedure/process, and not a K-H SQA process. The analysis process requires that the checker to validate assumptions and the calculation itself.

- Authorized users lists were not maintained for all applications.

- No formal list is available that identifies which version of the CFAST/FAST, HASS, and CAPARS software is authorized for use.

- No internal configuration identification exists to allow a user to determine when a given version of CFAST/FAST, HASS, and CAPARS software was/is appropriate for use.

- No single point of contact is identified for distributing authorized versions of software.

RFPO Closure Required: YES [X] NO [ ]

(F-5) Finding RFPO-04-0020-F05

K-H management assessment and independent assessment programs did not effectively address nuclear-related software reviewed.

Requirements:

1. 1-MAN-004-CSMM, *Computer Software Management Manual,*
   - Section 4. *Requirements,* J. *Assessment,* states, "Assessments SHALL be conducted for Nuclear-Related Software in accordance with applicable Site - applicable procedures, as necessary."
   - Section 4. *Requirements,* A. *General,* first three paragraph states in part, "Application Manager(s) shall develop a computer software management program for Nuclear-Related Software in use at the Site by applying the criteria specified in this manual. The computer software management program will include a discussion of how the criteria of this manual SHALL be satisfied and implemented. This criterion SHALL be applied using a graded approach (see Appendix 4 for criteria). Work SHALL be performed to established, technical standards and administrative controls using approved manuals, instructions, or other appropriate documentation in accordance with 1-MAN-001-SDRM."
   - Section 2. *Definitions, Nuclear-Related Software*, states, "The site software or software systems, including but not limited to software that is purchased, developed, or modified that is intended for use in connection with any activity that has potential to cause radiological harm. Nuclear-Related Software includes, but is not limited to, embedded software and software used to inventory, monitor, measure, control, and/or manipulate nuclear materials radiological waste, the immediate physical environment of such materials, and/or the health and safety of people who might be exposed to hazards from such materials."

2. MAN-131-QAPM, Version 3,
   - Section 6.3.2.1 *Criterion 10 (Independent Assessment-General Requirements, Requirement Source 10 CFR 830.122(j), states* "(1) Plan and conduct independent assessments to measure item and service quality, to measure the adequacy of work performance and to promote improvement. (2) Establish sufficient authority, and freedom from line management, for the group performing independent assessments."
   - Section 6.1.3.1 *Criterion 3 (Quality Improvement-General Requirements, Requirement Source 10 CFR 830.122(2)* states, (1) Establish and implement processes to detect and prevent quality problems. (2) Identify, control, and correct items, services, and processes that do not meet established requirements. (3) Identify the causes of problems and work to prevent recurrence as part of correcting the problem. (4) Review item characteristics, process implementation, and other quality-related information to identify items, services, and processes needing improvement."

Discussion:

The latest K-H SQA assessment/audit entitled "Defense Nuclear Facility Safety Board Nuclear Related Software," was completed over four years ago. No other management assessment or independent assessment has been completed at RFPO for the nuclear related software reviewed, since this audit.

Deficiencies identified in the latest SQA audit regarding computer software management, V&V, configuration management, and qualification of existing software still exist. This was evident from the repeated findings and observations identified by the team members during this assessment.

The SQA audit did not include within the original scope of their review RADIDOSE, HASS, CAPARS software applications. By K-H definition, these applications would qualify as Nuclear-Related software. By 10 CFR 830, these applications would qualify as software that could cause radiological harm. By the CRAD 4.1.4.1, these applications are the types of safety analysis and design software that are to be considered within the scope of DOE SQA assessments. It is not clear why these applications were not included within the scope of this audit.

CRAD 4.2.4.1, Section 3.1, states in part, "Individual sites should tailor the scope of this (SQA) assessment to suit the specific usage of analysis and design software in their safety systems. The types of safety analysis and design software that will be considered in the subject assessment are listed below. Database programs and associated user files used to maintain control of information that has nuclear safety implications." However after K-H was provided this information by the assessment team, K-H still did not believe that CAPARS belonged within the scope of this assessment.

The K-H CSMM Section 1.A. states that the requirements of this manual applies to nuclear-related Software where the consequence of inadequate data or control could result in radiological harm to Site workers, the public, or the environment as determined by the use of Appendix 3 Determination Checklist. This checklist includes "7. Determine or monitor personnel, facility, or environmental radiation exposure, release, radiation work limits, or dose rates. 9. Determine hazardous chemical exposure for personnel, facility, or the environment. 15. Determine, display, or implement emergency actions. 19. Collect, store, analyze, report, or characterize environmental protection related data." Any one of the above check list items characterizes CAPARS, however there was no objective evidence that showed where K-H identified and then managed this software application as nuclear related software. It should be noted that the State of Colorado accepted the use of CAPARS, however K-H could not find any documentation that shows what criteria or standards that the State used as a basis for their acceptance.

It is not clear how K-H can effectively implement their CSMM at RFPO, when they cannot adequately identify and assess nuclear-related Software that is under their control.

Also, it was not apparent as to why software deficiencies were identified by K-H over four years ago, were not adequately corrected at RFPO.

RFPO Closure Required: YES [X] NO [ ]

(F-6) Finding RFPO-04-0020-F6

Users of nuclear-related software reviewed were not trained on applicable regulations and procedures.

Requirements:

1. MAN-131-QAPM, Version 3,Section 6.1.2.1 *Criterion 2 (Personnel Training & Qualification-General Requirements, Requirement Source 10 CFR 830.122(b), states* "(1) Train and qualify personnel to be capable of performing their assigned work. (2) Provide continuing training to personnel to maintain their job proficiency."
2. 1-MAN-004-CSMM Revision 0, Section 4F, *Documentation and Records* states, "Documents **SHALL** be prepared, reviewed, approved, issued, used, and revised to prescribe processes, specify requirements, or establish design."

Discussion:

None of the RADIDOSE, CFAST/FAST, HASS, or CAPARS users were formally trained on applicable regulations, software engineering standards, or K-H nuclear related procedures/manuals.

In the case of RADIDOSE, a user-training manual does exist. It is relevant to version 1.4 of the RADIDOSE software application and it is assumable the same holds true with subsequent releases. With the training manual it describes the purpose of RADIDOSE, the user invoked functions, and the scenarios that it supports. There are references within the training manual that are specific to the nuclear safety discipline. However evidence of formal review, approval, issuance, and revisions for user documentation (as required by the CSMM), could not be found. Also, K-H did not have any subsequent releases of the RADIDOSE Training Manual which would address new and/or modified prescribed processes.

In the case of CFAST/FAST, a user's guide does exist and is published and maintained by the National Institute of Standards and Technology (NIST). This user's guide covers all areas of the CRAD 4.2.4.1 Revision 3 with the exception of maintaining the software. Since K-H does not develop this software and its associated support documentation, the CSMM requirements do not apply with the exception of review.

In the case of HASS, a user's guide does exist that is provided by the vendor, HRS Systems. This user's guide provides information in the areas of installation, operation, and management. Maintenance of the software is handled through the vendor and owner of the software, HRS Systems. All updates to the software and documentation are completed by the vendor and then disseminated by that vendor upon completion. Updates are provided based upon a service agreement signed with the vendor.

In the case of CAPARS, no user's guide has been reviewed or is available for review at Rocky Flats. CAPARS is a system that is maintained and operated by AlphaTRAC, an offsite lower tier sub-contractor to K-H. Numerous overviews and summaries exist for CAPARS, however it is the understanding of the assessment team that there is no one designated user of this system located at Rocky Flats

RFPO Closure Required: YES [X] NO [ ]

4.2 Observations

(O-1) Observation RFPO-04-0020-O01

K-H should retire nuclear-related software that is no longer in use.

Discussion:

With the completion of D&D for all RFPO nuclear facilities planned for October 2005, the assessment team observed that K-H had not yet began the process of retiring nuclear-related software. For example, CFAST/FAST and HASS had not been used since 1999, and 2001 respectively, but K-H had not begun retiring this software.

If there is a one year period of time where software can be retrieved from retirement, if deemed necessary, K-H should begin to consider spending the manpower and funds (while they are still available) to retire their nuclear-related software since only a year remains to do so.

RFPO Closure Required: YES [X] NO [ ]

(O-2) Observation RFPO-04-0020-O02

Improvement is needed in documenting the significance of nuclear-related software errors, and how these errors were managed/addressed within the associated nuclear facility safety analysis documentation.

Discussion:

The assessment team reviewed the "Safety Calculation Objective/Summary Description" for each version of RADIDOSE, and had observed versions 1.2 and 1.4.1 had errors notated. These documents stated that the errors were corrected, but it was not clear how significant the errors were. Also, there was no documentation trail which showed how there errors were addressed in the nuclear facility safety analysis documentation that was supported by these versions of RADIDOSE.

For example, the April 8, 1999 summary description for RADIDOSE version 1.2, states that it corrected a mistake in the enriched uranium criticality calculation. This mistake consisted of some "incorrect cell references in the whole-body dose calculations for the actinides." K-H could not provide any documentation that showed the significance of this error, or how it was addressed in any RFPO safety documentation.

The assessment team finally involved the RFPO nuclear safety/criticality subject matter expert (SME) who determined that only Building 886 had Uranium. The SME also found an Unreviewed Safety Evaluation Determination (USQD Number USQD-886-99.0856-BMM, dated April 15, 1999) had revised Building 886 inventory, which removed the need for a uranium criticality analysis. The USQD also stated the "Correcting the analytical errors in the previous consequence calculation resulted in higher estimated dose values with reduced material-at risk (MAR) values than reported in the current Building 886 BIO (Revision 5)." However the assessment team was still not able to determine if this error was the same as the one noted within the RADIDOSE summary description.

RFPO Closure Required: YES [X] NO [ ]

5.0 SUMMARY OF ASSESSMENT AREAS

The following provides a summary of assessment areas by the eight software quality assurance topics covered in the DOE CRAD. The lists of documents reviewed and personnel interviewed were organized according to the software application selected for assessment. These lists are provided in Appendix A-1 and A-2, respectively.

5.1 Software Requirements Description

Objective:

Software functions, requirements, and their bases are defined and documented.

Criteria:

1 **The functional and performance requirements for the software are complete, correct, consistent, clear, testable, and feasible.**
2. **The software requirements are documented and consistent with the safety basis.**
3. **The software requirements description is reviewed, controlled and maintained.**
4. **Each requirement should be uniquely identified and defined such that it can be objectively verified and validated.**

Summary:

The criteria were partially met.

One of the supporting drivers of K-H CSMM was derived from ASME-NQA-1, and this manual required that at the beginning of a computer software life cycle that each development, modification, or application effort shall identify the standards, conventions, techniques, or methodologies that guide nuclear-related software. However none of the applications reviewed had a formal software requirements description.

Related Findings and Observations:

Findings: (F-1, F-2)

5.2 Software Design Description

Objective:

The software design description (SDD) depicting the logical structure, information flow, logical processing steps, and data structures are defined and documented.

Criteria:

1. **All software related requirements are implemented in the design.**
2. **All design elements are traceable to the requirements.**
3. **The design is correct, consistent, clearly presented and feasible.**

Summary:

The criteria were partially met.

Of the software applications reviewed, alternative documentation had been developed and used supporting design. The design elements could not be easily traced for these applications, since formal requirements documentation did not exist.

Related Finding and Observation:

Finding: (F-2)

5.3 Software User Documentation

Objective:

Software documentation is available to guide the user in installing, operating, managing, and maintaining the software.

Criteria:

1. **The system requirements and constraints, installation procedures, and maintenance procedures such as database fine-tuning are clearly and accurately documented.**
2. **Any operational data system requirements and limitations are clearly and accurately documented.**
3. **Documentation exists to aid the users in correct operation of the software and to provide assistance for error conditions.**
4. **Appropriate software design and coding documentation to assist in future software modifications is defined and documented.**

Summary:

The criteria were partially met.

None of the users for RADIDOSE, CFAST/FAST, HASS, or CAPARS were formally trained on applicable regulations, software engineering standards, or K-H nuclear related software procedures and manuals.

The RADIDOSE user documentation does not provide guidance or direction pertaining to maintenance.

There are references within the RADIDOSE training manual that are specific to the nuclear safety discipline. However evidence of formal review, approval, issuance, and revisions for user documentation (as required by the CSMM), could not be found.

Related Findings and Observations:

Findings: (F-2, F-6)

5.4 Software Verification and Validation (V&V)

Objective:

The software V&V process is defined and performed, and related documentation is maintained to ensure that (a) the software adequately and correctly performs all intended functions, and (b) the software does not perform any unintended function.

Criteria:

1. **All analysis and design software requirements and software design have been verified and validated for correct operation using testing, observation, or inspection techniques.**
2. **Relevant abnormal conditions have been evaluated for mitigating unintended functions through testing, observation, or inspection techniques.**

Summary:

The criteria were partially met.

The RADIDOSE and CAPARS software applications had documentation of tests that were performed, however RADIDOSE tests were not performed to a consensus standard.

A V&V plan had not been developed, nor were test case specifications developed describing the expected outcome, during the original development of RADIDOSE, CAPARS, and their subsequent releases.

Acceptance testing of HASS was not completed prior to use, nor was there documentation supporting the selection of these applications for their intended use.

The intranet and Internet site applications that provide an interface to RADIDOSE and CAPARS (respectively) has undergone recent development changes, however K-H has conducted no formal test to validate the changes.

Related Findings and Observations:

Findings: (F-1, F-2)

5.5 Software Configuration Management

Objective:

Software components, products, and related documentation are identified and maintained; and changes to those items are controlled.

Criteria:

1. **All software components and products to be managed are identified.**
2. **For those components and products, procedures exist to manage the modification and installation of new versions.**
3. **Procedures for modifications to those components and products are followed.**

Summary:

The criteria were partially met.

The K-H CSMM provided excellent direction on how nuclear-related software was to be managed, however this manual was not followed. For example:

- The K-H SQA program had no configuration accounting for any nuclear-related software application reviewed.

- The RADIDOSE, and CAPARS software applications lacked configuration control.

- The CFAST/FAST, HASS, and CAPARS software applications lacked adequate configuration identification within the K-H QA program.

Related Findings and Observations:

Findings: (F-2, F-4)
Observation: (O-1)

5.6 Software Quality Assurance

Objective:

SQA activities are evaluated for applicability to the analysis and design software, defined to the appropriate level of rigor, and implemented.

Criteria:

1. **SQA activities and software practices for requirements management, software design, software configuration management, procurement controls, V&V (including reviews and testing), and documentation have been evaluated and established at the appropriate level for proper applicability to the software under assessment.**
2. **SQA activities have been effectively implemented.**

Summary:

The criteria were partially met.

While K-H had specific requirements in the CSMM governing their software life-cycle, these requirements were not always followed for the nuclear-related software applications reviewed.

SQA activities and software practices for requirements management, software design, software configuration management, procurement controls, V&V (including reviews and testing), and documentation have not been evaluated and established at the appropriate level for proper applicability to the analysis and design software reviewed during this assessment.

The assessment team determined that the K-H SQA activities as required in their CSMM have not been effectively implemented for the nuclear related software applications reviewed.

Related Findings and Observations:

Findings: (F-1 through F-6)
Observation: (O-1, O-2)

5.7 Software Procurement

Objective:

Vendor-supplied software, either COTS software, custom-developed or modified, requires the appropriate levels of QA commensurate with the level of risk introduced by their use.

Criteria:

1. **Procurement documents for acquisition of software programs identify the quality requirements appropriate for the level of risk introduced by their use.**
2. **Acquired software is verified to meet the identified quality requirements.**

Summary:

The criteria were partially met.

K-H did not have objective evidence that the supplier for HASS was evaluated prior to its use.

Related Findings and Observations:

Findings: (F-2, F-3)

5.8 Software Problem Reporting and Corrective Action

Objective:

Formal procedures for software problem reporting and corrective action for software errors and failures are established, maintained, and controlled.

Criteria:

1. **Practices and procedures for reporting, tracking, and resolving problems or issues identified in both software items and software development and maintenance processes are defined, documented and implemented.**
2. **Organizational responsibilities for reporting issues, approving changes, and performing corrective actions are identified and effective.**

Summary:

The criteria were partially met.

No formal system is in place for capturing the status of defect reports or change requests for RADIDOSE.

Improvement is needed for documenting decisions that affect the scope or applicability of software that is regulated by 10 CFR 830.

The K-H SQA program lacked formal direction on software problem reporting.

Related Findings and Observations:

Finding: (F-4)

Observation: (O-2)

6.0 Lessons Learned

The following summarizes the lessons learned for improving safety SQA assessment process and approach:

- A complete and accurate software inventory is needed. Assembling and obtaining a correct inventory of all the software that should be considered for this assessment was a far more difficult task than was anticipated. Perhaps a major factor that made this task difficult was the lack of K-H implementation of their own requirements to identify and control nuclear-related software (reference finding F-4).

7.0 References

1. *Quality Assurance for Safety Software at Department of Energy Defense Nuclear Facilities,* Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2002-1, U.S. Department of Energy, March 13, 2003.

2. MAN-131-QAPM, Rev. 3, *K-H Quality Assurance Program Manual, December 30, 2003.*

3. 10 CFR 830. (1-1-03 Edition) *Nuclear Safety Management*

4. 1-MAN-004-CSMM Rev. 0, *K-H Computer Software Management Manual, February 6, 1997, Change-01 (March 9, 1998), Change-02 (April 9, 1999), and Change-03 (January 1, 2001).*

5. *Quality Assurance Requirements for Computer Software for Nuclear Facility Applications,* ASME NQA-1, Subpart 2.7, The American Society of Mechanical Engineers.

6. *Assessment Criteria and Guidelines for Determining the Adequacy of Software Used in the Safety Analysis and Design of Defense Nuclear Facilities,* CRAD – 4.2.4.1, Revision 3, U.S. Department of Energy, October 24, 2003.

7. DOE O 414.1A, *Quality Assurance,* 9/29/2001

8. DOE O 420.1, *Facility Safety,* 10/13/1997

Appendix A-1

Documents Reviewed

Kaiser Hill, LLC. (K-H) Documents (GENERAL)

1-V51-COEM-DES-210, Rev. 7, *Site Engineering Process Procedure,* Effective September 26, 2002

FY00-116-KH, *Kaiser-Hill/Defense Nuclear Facility Safety Board Nuclear Related Software/Audit Report,* Approved July 5, 2000

USQD-886-99.0856-BMM, *1-C11-NSM-04.05 Unreviewed Safety Evaluation Determination/Error in Accident Consequence Analysis Discovered During Annual Update of Building 886 Basis for Interim Operations (BIO),* Approved April 15, 1999

USQD-RFP-99.0353-JSK, *1-C11-NSM-04.05 Unreviewed Safety Evaluation Determination/Discovery Issue-RMRS Safety Analysis Dose Calculation Deficiency, Solubility Class for Pu Defined Incorrectly,* Approved December 17, 1998

K-H Applications

RADIDOSE

CALC-771-01.0073-SKO-R02, *Building 771/774 Decommissionig BIO Consequence Calculations,* Approved June 5, 2001

CALC-RFP-00.00958-VLP, Rev 4, *RADIDOSE Version 1.4.3* December 26, 2001
CALC-RFP-00.00958-VLP, Rev. 3, *RADIDOSE Version 1.4.2,* April 3, 2001
CALC-RFP-00.00958-VLP, Rev. 2, *RADIDOSE Version 1.4.1,* April 3, 2001
CALC-RFP-00.00958-VLP, Rev. 1, *RADIDOSE Version 1.4,* July 31, 2000
CALC-RFP-00.00958-VLP, Rev. 0, *RADIDOSE Version 1.3,* March 8, 2000
Calc. No. 96-SAE-034, Rev. 2, *RADIDOSE Version 1.2,* April, 8, 1999
Calc. No. 95-SAE-034, Rev. 1, *RADIDOSE Version 1.2,* September 21, 1998
Calc. No. 96-SEA-034, Rev. 0, *RADIDOSE Version 1.2,* April 14, 1997

RFETS Intranet Departmental Web Site Publication Agreement, Dated September 18, 2002

RFETS Policy on Quality, Dated March 20, 2001

RADIDOSE Version 1.4 Training Manual, (no date)

RADIDOSE User List, (all versions), Dated August 23, 25, and 26, 2002

CFAST/FAST

http://fast.nist.gov/, *NIST Web Site for CFAST/FAST Software & Version History,* August 24, 2004

HASS

FHA-371-006 Revision 1, *Fire Hazards Analysis Building 371/374 Complex,* August 25, 2003

FHA-440-006, Rev 0, *Fire Hazards Analysis Building 440,* March 5, 2003

CALC-000-FPS-000272, Rev. 3, *Site Wide Hydraulic Requirements for Fire Suppression Systems,* September 6, 2002

CALC-440-FPS-000119, Rev. 0, *B440, R113, HSGS Facility,* May 1, 2001

CALC-440-FPS-000122, (no title), April 26, 2001

CAPARS

Evaluation of CAPARS Version 5.2 Model, April 24, 2003 (no approval signatures)

AlphaTRAC, Inc. Software Quality Program, Revision 2, October 15, 1999

Evaluation of the Computer-Assisted Protective Action Recommendation System (CAPARS) Version 3.0, January 5, 1998

CAPARS Overview Version 3.0, Design Document, (date unknown, and no approval signatures)

State of Colorado, Department of Public Health and Environment, Letter of Approval for CAPARS Version 3, February 24, 1998

Performance Evaluation of Terrain-Responsive Atomospheric Code (TRAC) Model/Final Report, October 27, 1993

Appendix A-2

Personnel Interviewed/Contacted

KAISER-HILL, LLC. (K-H)

Doyle Gillespie, K-H SQA POC

K-H SAFETY ANALYSIS AND DESIGN AND OTHER SOFTWARE

RADIDOSE
Jeff Conyers, K-H Nuclear Safety, RADIDOSE application POC

CFAST/FAST and HASS
Dave Tomecek, K-H Fire Protection Engineer, CFAST and HASS application POC

CAPARS
John Ciolek, AlphaTRAC, CAPARS application POC
Jack Pikas, AlphaTRAC SQA POC
Viktor Belenski, AlphaTRAC

Appendix B

Assessment Team Qualifications and Experience

Clifford A. Ashley, Team Leader – Mr. Ashley has been leading and participating in quality assurance assessments and surveillances during the last 14 years for the US DOE. This includes nine years experience as a DOE Facility Representative, as well as service as subject matter expert and various quality assurance positions with the New Production Reactor Project and the Tank Waste Remediation System Project. Several assessments included or were focused on configuration control and quality assurance of computer software applications.

During 1979 to 1981, Mr. Ashley's primary responsibility was to program a HP-1000 computer to record and extract critical test data from DOD sidewinder missile servomechanisms at China Lake Naval Weapons Center.

Mr. Ashley holds a baccalaureate degree in electrical engineering from Washington State University (1975), and a Master of Science degree in Electrical Engineering from North Dakota State University (1976).

From February 2004 to August 2004, Mr. Ashley participated in five DOE SQA assessments. These assessments evaluated the BNI Design and Analysis Software; FHI I&C, Design and Analysis Software; and CH2M HILL I&C, Design and Analysis Software. For the PNNL Design and Analysis SQA Assessment conducted in June 2004, Mr. Ashley was the Assessment Team Lead.

Airrus Trivett, Assessor – With ten years of comprehensive industry experience within Information Technology (IT), Mr. Trivett had obtained a diversified background with managing teams in an enjoyable and productive manner, creating flexible and effective procedures governing IT internal operations, bringing resolution to customer complaints and providing specific improvements to IT business support, and broad working knowledge of IEEE, SEI CMM/CMMI, CMII, and DOE procedures and guidelines.

From February 2003 to present, Mr. Trivett is assigned a the QA Manger for CH2M HILL, While working for DynCorp Systems & Solutions LLC from October 2002 to February 2003, he was assigned as the SQA Manger. From July 2000 toOctober2002, Mr. Trivett obtained significant experience in QA and SQA as a Test Manager.

Kent Grover, Assessor – Mr. Grover has worked for the Federal Government as a Computer Specialist or an Information Technology Specialist for over 21 years. The first 13 years were spent in positions of increasing responsibility with the Federal Deposit Insurance Corporation. In 1990, Mr. Grover was assigned to be the Regional Network Administrator for the Resolution Trust Corporation's Denver Regional Office. In this capacity, he led the project to build the regional computer network from less than 40 users to over 4,500 users in 11 months. This network covered 8 RTC offices located in Colorado, Arizona and California and had a first year operational budget of over 16 million dollars. In 1992, Mr. Grover was assigned to the FDIC National Programming Center in Denver, Colorado to serve as the Senior Network Administrator. This office developed all of the network applications used by FDIC nationwide. During this time he also served as the chairman of the FDIC National LAN Standards Committee which was responsible for developing policies and standards to be used by all 23,000 users on the FDIC nationwide network.

In 1996, Mr. Grover transferred to the Department of Energy Rocky Flats Field Office and was assigned responsibility for all IT technical services for RFFO. This included IT customer support (Help Desk), Network services, Telecommunications, IT Procurement and IT Strategic Planning. In 1997 he was responsible for the IT portion of consolidating approximately 450 DOE employees on the Rocky Flats Site into one building. Mr. Grover was then assigned to be the project leader for the installation of a new firewall/boundary protection system for the Rocky Flats site in 1999.

Also in 1999, Mr. Grover was assigned to be the project leader for the DOE portion of the Site Year 2000 Readiness Project. This project required a thorough assessment and documentation of every IT application and system on Site. In 2002, Mr. Grover was tasked with moving all IT services for DOE employees off of the Rocky Flats Site to commercial office space. In March of 2004, Mr. Grover was designated as the Chief Information Officer for the Rocky Flats Project Office. As the Rocky Flats site has continued to move toward closure, Mr. Grover is now tasked with "building down" all DOE related IT services for eventual termination or transfer to other DOE offices.